

Investigation: Sediment Incubation Experiments

Purpose: To observe and develop an understanding of exposure of wild rice roots to changes in concentration of sulfate, sulfide, and related chemicals over time and space (depth of sediment and distance from roots). These experiments will help to inform the seasonality component of the wild rice sulfate standard.

One high-priority hypothesis is that the conversion of sulfate to sulfide in anoxic subsurface sediment may harm the roots of wild rice, either directly, or indirectly. The rate at which sulfate from overlying water diffuses into and is converted to sulfide within different types of sediments (at high and low temperatures) is presently unknown. Additionally, the feasibility of maintaining environmentally relevant sulfide concentrations in laboratory experiments is also unknown, because wild rice plants may release oxygen from their roots.

This investigation will examine depth- and time-dependent concentrations of sulfate, sulfide, and iron in laboratory experiments in order to (a) provide a basis for comparing results from hydroponics studies to container mesocosms and field sites, (b) help identify the importance of oxygen release from wild rice roots, and (c) quantify the rate of diffusive transport of environmentally important chemicals into and out of sediment.

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Approach: Conduct sediment incubation experiments in the lab to measure, interpret, and then model, sulfide, sulfate, oxygen, and iron in the rooting environment of wild rice. In two different rooting environments, measure important chemical variables and construct a simple model.

Accomplishments to Date:

- **Primary Experiment—incubate sediment in the lab and mimic winter discharge of sulfate:**
- Homogenized sediment was collected from two sites in January, 2013, and allowed to settle in replicate 8-inch diameter microcosms in the lab. No wild rice will be grown in this sediment.
- To investigate the effects of temperature on sulfate flux and conversion to sulfide, half of the microcosms are being incubated at 25° C and the other half at 4° C. Initially, low sulfate water will be maintained over the sediment. Subsequently, sulfate water concentrations will be increased by a large factor (10-100 times the baseline concentration) for a period of about two months, mimicking a temporary sulfate discharge. Finally, overlying water sulfate concentrations will be reduced back to ambient concentrations for a period of about two months, during which time the temperature of the 4° C treatments will be increased to 25° C, mimicking spring.

Next Steps:

- Periodically collect samples from the sediment microcosms for analysis.
- Working with Dr. Pastor, measure sulfide in sulfide-enriched growth media to determine the rate that sulfide is oxidized as a result of oxygen release by wild rice roots.
- Model sulfide, sulfate, oxygen and iron in rooting zone of wild rice